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Attorney Docket No.: 5308-413

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor: Saxler et al.

Confirmation No.: 9882

Application No.: 10/849,617

Group Art Unit: 2811

Filed: May 20, 2004

Examiner: Unknown

For: METHODS OF FABRICATING NITRIDE-BASED TRANSISTORS HAVING  
REGROWN OHMIC CONTACT REGIONS AND NITRIDE-BASED TRANSISTORS  
HAVING REGROWN OHMIC CONTACT REGIONS

Date: August 24, 2004

Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. § 1.97(b)**

Sir:

Attached is a list of documents on Form PTO-1449, together with a copy of any listed foreign patent document and/or non-patent literature. A copy of any listed U.S. patent and/or U.S. patent application publication is not provided herewith in accordance with the waiver by the U.S. Patent and Trademark Office of requirements under 37 C.F.R. § 1.98(a)(2)(i) for all U.S. national patent applications filed after June 30, 2003 and for all international applications that have entered the national stage under 35 USC § 371 after June 30, 2003.

It is requested that these documents be considered by the Examiner and officially made of record in accordance with the provisions of 37 C.F.R. § 1.56 and Section 609 of the MPEP.

This Information Disclosure Statement is submitted in accordance with 37 C.F.R. § 1.97(b), within three months of the filing date of the above-referenced application or before the mailing of a first Office Action on the merits, whichever event occurs last. Therefore, no fee is believed due. However, the Commissioner is hereby authorized to charge any deficiency or credit any overpayment to Deposit Account No. 50-0220.

Respectfully submitted,

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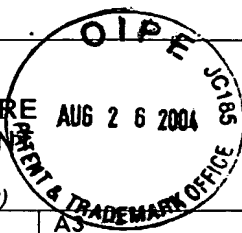
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Erin A. Campion

Substitute form 1449A/PTO

**INFORMATION DISCLOSURE  
STATEMENT BY APPLICANT**

(use as many sheets as necessary)

Sheet **A1** of **A3***Complete if Known*

Application Number	10/849,617
Filing Date	May 20, 2004
First Named Inventor	Saxler
Group Art Unit	2811
Examiner Name	To Be Assigned
Attorney Docket Number	5308-413

**U.S. PATENTS AND PATENT PUBLICATIONS**

Examiner Initials*	Cite No.	U.S. Patent Document		Name of Patentee or Applicant of Cited Document	Date of Publication of Cited Document MM-DD-YYYY
		Number	Kind Code (if known)		
	1.	Re. 34,861		Davis et al.	02-14-1995
	2.	6,639,255		Inoue et al.	10-28-2003
	3.	6,586,781		Wu et al.	07-01-2003
	4.	6,548,333		Smith	04-15-2003
	5.	6,515,316		Wojtowicz et al.	02-04-2003
	6.	6,448,648	B1	Boos	09-10-2002
	7.	6,429,467		Ando	08-06-2002
	8.	6,316,793		Sheppard	11-13-2001
	9.	6,218,680	B1	Carter, Jr. et al.	04-17-2001
	10.	6,177,685	B1	Teraguchi et al.	01-23-2001
	11.	6,064,082		Kawai et al.	05-16-2000
	12.	6,046,464		Schetzina	04-04-2000
	13.	6,028,328		Riechert et al.	02-22-2000
	14.	5,946,547		Kim et al.	08-31-1999
	15.	5,885,860		Weitzel et al.	03-23-1999
	16.	5,705,827		Baba et al.	01-06-1998
	17.	5,701,019		Matsumoto et al.	12-23-1997
	18.	5,523-589		Edmond et al.	06-04-1996
	19.	5,393,993		Edmond et al.	02-28-1995
	20.	5,298,445		Asano	03-29-1994
	21.	5,296,395		Khan et al.	03-22-1994
	22.	5,292,501		Degenhardt et al.	03-08-1994
	23.	5,210,051		Carter, Jr.	05-11-1993
	24.	5,200,022		Kong et al.	04-06-1993
	25.	5,192,987		Khan et al.	03-09-1993
	26.	5,172,197		Nguyen et al.	12-15-1992
	27.	5,053,348		Mishra et al.	10-01-1991
	28.	4,946,547		Palmour et al.	08-07-1990
	29.	4,788,156		Stoneham et al.	11-29-1988
	30.	4,727,403		Hilda et al.	02-23-1988
	31.	4,471,366		Delagebeaudeuf et al.	09-11-1984
	32.	4,424,525		Mimura	01-03-1984
	33.	2004/0061129	A1	Saxler et al.	04-01-2004
	34.	2004/0029330	A1	Hussain et al.	02-12-2004
	35.	2004/0021152	A1	Nguyen et al.	02-05-2004
	36.	2003/0102482	A1	Saxler	06-05-2003
	37.	2003/0020092	A1	Parikh et al.	01-31-2003
	38.	2002/0167023	A1	Chavarkar et al.	11-14-2002
	39.	2002/0066908	A1	Smith	06-06-2002
	40.	2002/0017696	A1	Nakayama et al.	02-14-2002
	41.	2001/0023964	A1	Wu et al.	09-27-2001
	42.	2001/0020700	A1	Inoue et al.	09-13-2001
	43.	2001/0015446	A1	Inoue et al.	08-23-2001

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Substitute form 1449A/PTO				<b>Complete if Known</b>	
<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b>  (use as many sheets as necessary)				Application Number	10/849,617
				Filing Date	May 20, 2004
				First Named Inventor	Saxler
				Group Art Unit	2811
				Examiner Name	To Be Assigned
Sheet	A2	of	A3	Attorney Docket Number	5308-392

FOREIGN PATENT DOCUMENTS							
Examiner Initials*	Cite No.	Foreign Patent Document			Name of Patentee or Applicant of Cited Document	Date of Publication of Cited Document MM-DD-YYYY	T
		Office	Number	Kind Code (if known)			
	44.	PCT	WO 03/049193	A1	Cree, Inc.	06-12-2003	
	45.	JP	2002016087	A	NEC Corp	01-18-2002	Abstract
	46.	JP	2001230407	A	Matsushita Electric Industrial Co. Ltd.	08-24-2001	Abstract
	47.	PCT	WO 01/57929	A1	Cree Lighting Company	08-09-2001	
	48.	JP	10-050982		Nippon Telegraph & Telephone Corp.	02-20-1998	Abstract
	49.	PCT	WO 93/23877	A1	Massachusetts Institute of Technology	11-25-1993	
	50.	EP	0 563 847	A2	Matsushita Electric Industrial Co., Ltd.	10-06-1993	

OTHER NON PATENT LITERATURE DOCUMENTS							
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published					T
	51.	Asbeck et al. "Piezoelectric charge densities in AlGaIn/GaN HFETs," <i>Electronics Letters</i> . Vol. 33, No. 14, pp. 1230-1231 (1997).					
	52.	Ben-Yaacov et al., "AlGaIn/GaN Current Aperture Vertical Electron Transistors with Regrown Channels," <i>Journal of Applied Physics</i> . Vol. 95, No. 4, pp. 2073-2078 (2004).					
	53.	Breitschadel et al. "Minimization of Leakage Current of Recessed Gate AlGaIn/GaN HEMTs by Optimizing the Dry-Etching Process," <i>Journal of Electronic Materials</i> . Vol. 28, No. 12, pp. 1420-1423 (1999).					
	54.	Burm et al. "Recessed Gate GaN MODFETS," <i>Solid-State Electronics</i> . Vol. 41, No. 2, pp. 247-250 (1997).					
	55.	Burm et al. "Ultra-Low Resistive Ohmic Contacts on n-GaN Using Si Implantation," <i>Applied Physics Letters</i> . Vol. 70, No. 4, 464-66 (1997).					
	56.	Chen et al. "Cl2 reactive ion etching for gate recessing of AlGaIn/GaN field-effect transistors," <i>J. Vac. Sci. Technol. B</i> . Vol. 17, No. 6, pp. 2755-58 (1999).					
	57.	Eastman et al. "GaN materials for high power microwave amplifiers," <i>Mat. Res. Soc. Symp. Proc.</i> Vol. 512 (1998).					
	58.	Eastman et al. "Undoped AlGaIn/GaN HEMTs for Microwave Power Amplification," <i>IEEE Transactions on Electron Devices</i> . Vol. 48, No. 3, pp. 479-85 (March 2001).					
	59.	Egawa et al. "Recessed gate AlGaIn/GaN MODFET on Sapphire Grown by MOCVD," <i>Applied Physics Letters</i> . Vol. 76, No. 1, pp. 121-123 (January 2000).					
	60.	Gaska et al. "High-Temperature Performance of AlGaIn/GaN HFET's on SiC Substrates," <i>IEEE Electron Device Letters</i> . Vol. 18, No. 1, pp. 492-494 (October 1997).					
	61.	Gaska et al. "Electron Transport in AlGaIn/GaN Heterostructures Grown on 6H-SiC Substrates," <i>Applied Physics Letters</i> . Vol. 72, No. 6, pp. 707-709 (February 1998).					
	62.	Gelmont et al. "Monte Carlo simulation of electron transport in gallium nitride," <i>Journal of Applied Physics</i> . Vol. 74, No. 3, pp. 1818-1821 (August 1993).					
	63.	Heikman, et al., "Mass Transport Regrowth of GaN for Ohmic Contacts to AlGaIn/GaN," <i>Applied Physics Letters</i> . Vol. 78, No. 19, pp. 2876					
	64.	Heikman et al. "Polarization Effects in AlGaIn/GaN and GaN/AlGaIn/GaN heterostructures," <i>Journal of Applied Physics</i> . Vol. 93, No. 12, pp. 10114-10118 (June 2003).					
	65.	Heikman et al., "Growth of Fe-Doped Semi-insulating GaN by Metalorganic Chemical Vapor Deposition," <i>Applied Physics Letters</i> . Vol. 83, No. 1, pp. 439-441 (July 2002).					
	66.	Heikman, Sten J., <i>MOCVD Growth Technologies for Applications in AlGaIn/GaN High Electron Mobility Transistors</i> , Dissertation, University of California—Santa Barbara, September 2002, 190 pages.					
	67.	Karmalkar et al. "Enhancement of Breakdown Voltage in AlGaIn/GaN High Electron Mobility Transistors Using a Field Plate," <i>IEEE Transactions on Electron Devices</i> . Vol. 48, No. 8, pp. 1515-1521 (August 2001).					
	68.	Karmalkar et al. "RESURF AlGaIn/GaN HEMT for High Voltage Power Switching," <i>IEEE Electron Device Letters</i> . Vol. 22, No. 8, pp. 373-375 (August 2001).					
	69.	Kuzmik et al. "Annealing of Schottky contacts deposited on dry etched AlGaIn/GaN," <i>Semiconductor Science and Technology</i> . Vol. 17, No. 11 (November 2002).					
	70.	Neuburger et al. "Design of GaN-based Field Effect Transistor Structures based on Doping Screening of Polarization Fields," <i>WA 1.5, 7th Wide-Gandgap III-Nitride Workshop</i> (March 2002).					
	71.	Ping et al. "DC and Microwave Performance of High-Current AlGaIn/GaN Heterostructure Field Effect Transistors Grown on p-Type SiC Substrates," <i>IEEE Electron Device Letters</i> . Vol. 19, No. 2, pp. 54-56 (February 1998).					

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OTHER NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T
	72.	Sheppard et al. "High Power Demonstration at 10 GHz with GaN/AlGaIn HEMT Hybrid Amplifiers." Presented at the 58 <sup>th</sup> DRC, Denver, CO, June 2000.	
	73.	Sheppard et al. "Improved 10-GHz Operation of GaN/AlGaIn HEMTs on Silicon Carbide," <i>Materials Science Forum</i> . Vols. 338-342, pp. 1643-1646, (2000).	
	74.	Shen et al., "High-Power Polarization-Engineered GaN/AlGaIn/GaN HEMTs Without Surface Passivation," <i>IEEE Electronics Device Letters</i> . Vol. 25, No. 1, pp. 7-9 (2004).	
	75.	Sriram et al. "RF Performance of AlGaIn/GaN MODFET's on High Resistivity SiC Substrates," Presentation at Materials Research Society Fall Symposium, 1997.	
	76.	Sriram et al. "SiC and GaN Wide Bandgap Microwave Power Transistors," <i>IEEE Samoff Symposium</i> , Pittsburgh, PA, March 18, 1998.	
	77.	Sullivan et al. "High-Power 10-GHz Operation of AlGaIn HFET's on Insulating SiC," <i>IEEE Electron Device Letters</i> . Vol. 19, No. 6, pp. 198-200 (June 1998).	
	78.	Wu et al. "30-W/mm GaN HEMTs by Field Plate Optimization," <i>IEEE Electron Device Letters</i> . Vol. 25, No. 3, pp. 117-119 (March 2004).	
	79.	Wu et al. "High Al-Content AlGaIn/GaN MODFET's for Ultrahigh Performance," <i>IEEE Electron Device Letters</i> . Vol. 19, No. 2, pp. 50-53 (February 1998).	
	80.	Yu et al. "Schottky barrier engineering in III-V nitrides via the piezoelectric effect," <i>Applied Physics Letters</i> . Vol 73, No. 13, pp. 1880-1882, (September 1998).	
	81.	United States Patent Application entitled "Co-Doping for Fermi Level Control in Semi-Insulating Group III Nitrides," filed January 7, 2004 (Attorney Docket No. 5308-371).	
	82.	United States Patent Application entitled "Nitride Heterojunction Transistors Having Charge-Transfer Induced Energy Barriers and Methods of Fabricating the Same," Serial No. 10/772,882, filed February 5, 2004 (Attorney Docket No. 5308-389).	
	83.	United States Patent Application entitled "Nitride-Based Transistors with a Protective Layer and a Low-Damage Recess and Methods of Fabrication Thereof," Serial No. 10/758,871, filed January 16, 2004 (Attorney Docket No. 5308-291).	
	84.	United States Patent Application entitled "Nitride-Based Transistors and Methods of Fabrication Thereof Using Non-Etched Contact Recesses," Serial No. 10/617,843, filed July 11, 2003 (Attorney Docket No. 5308-248).	
	85.	United States Patent Application entitled "Semiconductor Devices Having a Hybrid Channel Layer, Current Aperture Transistors and Methods of Fabricating the Same," Serial No. 10/849,589, filed May 20, 2004 (Attorney Docket No. 5308-412).	
	86.	United States Patent Application entitled "Methods of Fabricating Nitride-Based Transistors with a Cap Layer and a Recessed Gate," filed July 23, 2004 (Attorney Docket No. 5308-392).	
	87.	United States Patent Application entitled "Methods of Having Laterally Grown Active Region and Methods of Fabricating Same," filed July 26, 2004 (Attorney Docket No. 5308-374).	
	88.	United States Patent Application entitled, "Silicon Carbide on Diamond Substrates and Related Devices and Methods," (Cree Docket No. P0387).	

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